



**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION 8**

1595 Wynkoop Street  
DENVER, CO 80202-1129  
Phone 800-227-8917  
<http://www.epa.gov/region08>

OCT 29 2014

Ref: 8P-W-UIC

Carl Anderson  
UIC Manager  
North Dakota Department of Health  
Division of Water Quality  
918 East Divide Avenue, 4<sup>th</sup> Floor-  
Bismarck, North Dakota 58501-1947

RE: Underground Injection Control (UIC) Program  
Class I Injection into the Class II Exempted Dakota  
Formation Aquifer  
Great River Energy Injection Well, McLean  
County North Dakota

Dear Mr. Anderson:

As requested, the U.S. Environmental Protection Agency Region 8 (EPA) Water Program office has reviewed the North Dakota Department of Health (NDDoH) submittal for a proposed aquifer exemption into the Dakota Formation. The proposed injection is into a previously exempted portion of the Dakota Formation. The original exemption was granted for Class II purposes as part of the North Dakota Industrial Commission's (NDIC) 1425 primacy application. The new exemption proposal is for Class I disposal.

The request is associated with the proposed Great River Energy (GRE) Class I injection well located in Section 17, Township 145 North, Range 82 West in McLean County, North Dakota. The proposed injectate is associated with power production and operations at the Coal Creek Station power plant in Underwood, North Dakota. No hazardous waste or materials are to be disposed of in the proposed well. Water quality of the injectate is approximately 17,000 mg/L total dissolved solids (TDS), but varies based on plant operation, including the volume of stormwater collected from the site.

Based on review of the supporting information provided by the applicant and NDDoH, and pursuant to 40 CFR §§ 144.7 and 146.4 and the EPA Ground Water Protection Branch Guidance #34, the EPA approves the proposed aquifer exemption in the previously exempted Dakota Formation within one-half (½) mile of the GRE Class I injection well. The top of the Dakota Formation is at approximately 3,550 in depth with a thickness of 350 feet. The aquifer exemption is bounded by the Skull Creek Formation above and the Swift Formation below.

OVERVIEW: This request for injection activity is being proposed to the NDDoH by GRE. The aquifer exemption is associated with the proposed GRE Class I injection well. When the NDIC applied for 1425 Primacy in 1983, it also applied to exempt the Dakota Formation in the western part of the state. The exemption was granted for Class II purposes and the formation has been receiving Class II wastes throughout the exempted area since. The location of the current proposal is within the already exempted portion of the Dakota formation.

The area where the proposed aquifer exemption request is located does not currently serve as a drinking water source. The nearest domestic well is located 60 miles to the east of the proposed well. Additionally, it is technically and financially infeasible to use the Dakota Aquifer in this area as a drinking water source. There is an ample supply of water for the foreseeable future in the shallower aquifers in the area based on population projects. The cost to drill, operate and treat water produced from the Dakota Formation in the area is also prohibitively expensive relative to the shallower water sources. NDDoH received no public comments on the proposed injection well permit or on the proposed aquifer exemption. EPA approves with the state's decision to allow Class I injection into the Dakota Formation at the proposed location.

Sincerely,



Callie A. Videtich

Acting Assistant Regional Administrator

Office of Partnerships and Regulatory Assistance

Cc: Robert EU Smith, OGWDW

**U.S. EPA Region 8  
Underground Injection Control Program**

**AQUIFER EXEMPTION RECORD OF DECISION**

This Record of Decision provides EPA's aquifer exemption (AE) decision, background information concerning the AE request, and the basis for the AE decision.

**Primacy Agency:** North Dakota Department of Health (NDDoH) 1422 Program

**Date of Aquifer Exemption Request:** September 3, 2014

**Substantial or Non-Substantial Program Revision:** Non-Substantial

Although EPA must approve all revisions to EPA-approved state Underground Injection Control (UIC) programs, the process differs depending on whether EPA treats the revision as a substantial or non-substantial program revision. EPA treated this as a non-substantial program revision because it is associated with the issuance of a site-specific Class I UIC permit action, not a state-wide programmatic change or a revision with implications for the national UIC program. The decision to treat this as a non-substantial program revision is also consistent with EPA's "Groundwater for Review and Approval of State Underground Injection Control (UIC) Programs and Revisions to Approved State Programs" (Guidance 34). This is a non-substantial program revision because the aquifer is already exempted for Class II purposes; the injectate is non-hazardous; and aquifer is relatively deep compared to other available water supply sources in the area.

**Operator:** Great River Energy (GRE)

**Well/Project Name:** Great River Energy Coal Creek Station Class I Injection Well

**Well/Project Permit Number:** ND-UIC-106

**Well/Project Location:** NE ¼ Section 17 of Township 145N, Range 82W

**County:** McLean

**State:** ND

**Well Class /Type:** Class I- Industrial non-hazardous

**DESCRIPTION OF PROPOSED AQUIFER EXEMPTION**

**Aquifer to be Exempted:** A portion of the Dakota Formation.

**Water Quality – Total Dissolved Solids (TDS) (mg/L):** 5,000 – 7,000mg/L (Estimated)

**Depth and Thickness of Aquifer (feet):** The depth to the top of the Dakota Formation is approximately 3,550 feet below ground surface. The thickness of the Dakota Formation is estimated to be 350 feet at this site. The exempted portion of the Dakota Formation includes this entire vertical interval and is confined above and below by low permeability claystone and shale.

**Areal Extent of Aquifer:** The areal extent of the exemption is a 2,880 foot radius around the proposed injection well, all within GRE's property boundary. GRE has provided particle track modeling for the proposed injection over a 50-year period. GRE ran several models and ran a

sensitivity analysis as part of their submittal. In the submitted Figure 2.6 (Application) with the AE application, particle tracks show a down gradient travel radius of 2,400 feet. Based on other modeling data as part of GRE's application, EPA determined a safety factor of 20 percent was appropriate increasing the exempted radius to 2,880 feet.

**Confining Zone(s):** The Dakota Formation is overlain by low permeability claystone and shale of the Pierre, Niobrara, Carlile, Greenhorn, Mowry formations. In the vicinity of the project, the thickness of the upper confining units is approximately 2,475 feet. The lower confining unit is the Swift Formation. This formation consists of approximately 750 feet of shale interbedded with sandstone and siltstone. These upper and lower confining units are continuous across the exemption area.

**Injectate Characteristics:** The proposed injectate is industrial, non-hazardous, process water from the Coal Creek Station. This includes cooling tower water and surface stormwater management fluids. The TDS of these fluids is approximately 17,000 mg/L.

**Regulatory Criteria for AE Request:** The NDDoH has proposed exemption under the criteria at 40 CFR § 146.4(a) and (b)(2). NDDoH determined that the area proposed for exemption is not currently a source of drinking water and cannot now and will not in the future be a source of drinking water. The cost to drill and treat the water from this aquifer is prohibitive based on the availability of other water sources and the expected population growth of the area. Additionally the area of the proposed aquifer exemption is located within an existing aquifer exemption for Class II purposes. Based on a comparison of the typical Class II injectates and the proposed injectate from the power plant, the power plant injectate contains lower TDS and other contaminants.

The area approved for exemption is a 2,880 foot radius around the proposed injection well all within GRE's property (see Attachment 1, Figure 2.5 and 2.6).

The exempted area was determined based on transport modeling analysis with a safety factor performed by Golder Associates, the applicant's consultant. The steady-state and transient models used AquiferWin32 software to calculate the area that 50 years of continuous pumping of at 500 gpm would affect. The model conservatively assumed that chemical constituents would travel at the same rate as water particles. The model predicts the distance of travel being slightly less than ½ mile downgradient from the injection well. This keeps all injectate within the area of the proposed exemption area of GRE's Coal Creek Station site.

## **BACKGROUND**

Coal Creek Station is a 1,100-megawatt coal-fired electric generation facility owned and operated by Great River Energy (GRE). The plant is located approximately six miles south of the city of Underwood in McLean County, North Dakota. The main plant area occupies five sections of land (8, 9, 15, 16 & 17) in Township 145 North, Range 82 West, and portions of additional nearby sections.

Four on-site evaporation ponds (Evaporation Ponds 91 to 94) are used to manage the overall water inventory at Coal Creek Station. Coal Creek Station operates as a zero liquid discharge (ZLD) facility and is not permitted to discharge water under a National Pollutant Discharge

Elimination System (NPDES) permit. The evaporation ponds at Coal Creek Station provide water storage capacity for the plant; excess water inventory is removed through evaporation from the ponds.

Over the last few years, the evaporation ponds have filled to design capacity due to plant environmental control improvements (e.g., scrubber modifications) and wetter-than-normal climate conditions. GRE has been implementing water management strategies, which include higher operating elevations for ponds, operational changes, mechanical evaporators and pond liner extensions. To provide additional flexibility and capacity for plant water management, GRE submitted a permit application to the NDDoH to install one Class I non-hazardous injection well.

The proposed injection zone is the Inyan Kara Formation, which is part of the Dakota Group. The Dakota Group also includes the Mowry, Newcastle and Skull Creek Formations. While various terms have been used to describe this geologic unit, including the Lower Cretaceous aquifer, Inyan Kara Group, Fall River Formation, Fuson Formation and Lakota Formation, it is generally acceptable to simply reference it as the "Dakota aquifer".

In the vicinity of Coal Creek Station the total dissolved solids (TDS) concentration of Dakota aquifer water is not known, but it is anticipated to be between 3,000 milligrams per liter (mg/l) and 10,000 mg/l. Consequently, an aquifer exemption is required to inject Coal Creek Station's plant water into the Dakota aquifer. GRE submitted an Aquifer Exemption Request to the NDDoH to allow injection of excess water into the Dakota aquifer. GRE's aquifer exemption request is attached to this document and provides detailed information regarding the appropriateness of granting the exemption pursuant to 40 CFR § 146.4.

## **BASIS FOR DECISION**

### **Underground Source of Drinking Water (USDW)**

The Dakota aquifer may be a USDW at this project site. No TDS water samples from the Dakota Formations have been collected at the site; however, calculation estimate the range from 5,000 to 7,000 mg/L within the area. The water quality and its yield qualify the Dakota Formations as a USDW and requires an AE to inject under a Class I permit.

### **Regulatory Criteria under which the exemption is approved**

**40 CFR § 146.4(a)** *It does not currently serve as a source of drinking water*

Although groundwater is used as a source of drinking water within McLean County, the primary source of drinking water comes from the Missouri River and Lake Sakakawea. An extensive search was conducted using data from the North Dakota State Water Commission (NDSWC) for the documented Dakota aquifer wells (including domestic, municipal, irrigation and industrial wells) in McLean County and in parts of Sheridan and Oliver Counties. The nearest down-gradient water supply well drilled into the Dakota aquifer is a private well located approximately 60 miles northeast of the Coal Creek Station. Figure 5 shows all the documented water supply wells in North Dakota that produce water from the Dakota aquifer. Therefore, the Dakota aquifers do not currently serve as a source of drinking water in or near the aquifer exemption area.

An aquifer exemption for the Dakota aquifer already exists within Coal Creek Station's property boundaries for Class II wells. While not directly applicable to GRE's proposed Class I non-hazardous well, the Class II exemption provides support and precedent for a Class I exemption. Based on the information presented in this document, the NDDoH requests that the Dakota aquifer below the property boundary of GRE's Coal Creek Station be exempted from protection as an underground source of drinking water for Class I underground injection wells.

The Dakota aquifer is the shallowest consolidated-rock aquifer in eastern North Dakota and is a primary source of water for livestock watering and domestic supply. Groundwater in the Dakota aquifer flows regionally northeastward from recharge areas in central Montana and northeast Wyoming to discharge areas in eastern North Dakota and South Dakota near the Red River. The shallower bedrock aquifers present in the western and middle portions of the state, including the Fox Hills Formation, pinch out in central North Dakota.

#### **40 CFR § 146.4(b)(2)**

*It cannot now and will not in the future serve as a source of drinking water because:*

*It is situated at a depth or location which makes recovery of water for drinking water purposes economically or technologically impractical.*

As demonstrated above, the Dakota aquifer is not currently used as a source of drinking water near the proposed injection site or in McLean County. The likely reasons the Dakota aquifer has not been developed as a water supply source closer to the proposed injection site include:

- The presence of several higher-quality groundwater and surface water supplies that are more easily accessible;
- Greater depth than is practical to drill for a municipal or domestic water well; and
- High salinity/low quality, necessitating significant investments for treatment.

These factors also explain why the Dakota aquifer is unlikely to be used in the future as a source of drinking water for McLean County residents. Current surface and underground sources of drinking water in McLean County are more easily accessible and of better quality than the Dakota aquifer. In addition, drilling to the Dakota aquifer and/or treating water from that aquifer would be expensive for a small community. Additional details regarding the information presented in this section can be found in GRE's Aquifer Exemption Request (Attachment 1)

#### Economic Cost Evaluation

An economic evaluation was prepared by GRE to compare the costs of supplying a given municipal system with water from the Dakota aquifer versus the current cost of water supplied by a nearby municipality. The evaluation was completed for the two towns nearest to Coal Creek Station, Washburn and Underwood, which currently obtain water from surface water sources. Costs for the Dakota aquifer water supply system were limited to supply, delivery, and treatment; distribution costs were excluded. The intent of the evaluation was to develop costs for comparison purposes; it was not intended to estimate detailed costs for a full water supply and distribution system. The economic evaluation included the following steps:



- Develop the design flow rate. The design flow rate, required for basic sizing of infrastructure, was selected based on historic water usage of Washburn and Underwood. Actual water demand is variable, so for simplification this evaluation used one flow rate, intended to be conservative, for each town.
- Estimate capital costs. These costs included drilling one well to the Dakota aquifer, installing a well pump and pipeline to deliver water to the town, providing power to the well pump, and constructing a water treatment facility.
- Estimate operation and maintenance (O&M) costs. These costs included power to run the well pumps and O&M costs associated with the water treatment facility.
- Estimate the cost of water for the Dakota aquifer system. A cash flow analysis was completed to estimate the cost per 1,000 gallons required to recover expenditures.
- Compare the estimated Dakota aquifer system cost with a simplified current cost estimate of water for each town. The simplified current cost of water combined the towns' base and surplus rates into one rate using per capita water usage.

The estimated costs were calculated using vendor and contractor quotes, data supplied by the towns of Washburn and Underwood, and the engineering judgment and experience of Golder Associates, GRE's contracted engineering firm. The estimated capital costs, O&M costs, and cost of water per 1,000 gallons for a Dakota aquifer water treatment system, as well as the estimated cost of water per 1,000 gallons for the current systems of both Washburn and Underwood. For Washburn, the Dakota aquifer system cost of \$25.14/1,000 gallons is 170% greater than the current cost of \$9.34/1,000 gallons. For Underwood, the Dakota aquifer system cost of \$41.19/1,000 gallons is 510% greater than the current cost of \$6.76/1,000 gallons. Since the estimated Dakota aquifer system costs exclude distribution, the actual costs of the Dakota aquifer system would be even higher. The cost to install a public water supply well in the formation would cost between \$1.2 and \$1.6 million for the cities of Underwood and Washburn, respectively.

#### Summary of Current and Future Water Supply in McLean County

McLean County is largely reliant on surface water for its drinking water supply. Lake Sakakawea and the Missouri River provide much of the water consumed in the county, particularly in urban areas such as Garrison and Washburn. However, groundwater is an important part of the rural water supply, through the McLean Sheridan Joint Water Resource Board, private wells, and emergency municipal supplies. These wells predominantly extract water from the shallow glacial drift aquifers, although bedrock formations such as the Fort Union Group, the Hell Creek Formation and the Fox Hills Formation are also used for water supply. The Dakota aquifer underlies the Fox Hills Formation. However, unlike the latter formation, the Dakota aquifer is not used and likely will not be used in the county for drinking water supply. The reasons for this include:

- The Dakota aquifer is too deep to be an economically viable source of drinking water for communities in McLean County.

- Water from the Dakota aquifer is much more saline than area surface water or other groundwater sources in the county, and would be difficult for a small community to treat.
- Current population projections for McLean County, even when taking into account the recent increase in energy activity in the state, do not indicate that any additional water supply will be necessary in the near future in McLean County.

The first two reasons are evident in the results of the economic evaluation described above - drilling to the Dakota aquifer and/or treating water from that aquifer would likely be too costly for a small community. The predicted depth to the Dakota aquifer near the proposed injection site, 3,550 feet, is not by itself prohibitive. Many municipalities in the Midwest, including Rapid City, South Dakota and Waukesha, Wisconsin, rely on groundwater from wells between 2,000 and 4,000 feet in depth. However, these cities have approximate populations between 68,000 and 70,000; by contrast, Garrison, the largest community in McLean County, has a population under 1,500. It is not practical for such a small community to drill a well to that depth and pipe water several miles, particularly when other supplies are readily available and significantly less expensive. Similarly, treatment of Dakota aquifer water, with its TDS of around 6,500 mg/l, would be expensive for a small municipality. Without rapid population growth, a small community has little reason to go to such a deep and saline aquifer for drinking water supply. The United States Census Bureau estimates that the population of McLean County was approximately 9,520 as of July 1, 2013, which represents an increase of about 6 % since the 2010 census. If the current population trends continue as expected, current water supplies will easily meet the needs of future populations. Under those conditions, the extraction of water from the Dakota aquifer for public water supply in McLean County will be both economically impractical and unnecessary.

#### **Ensuring Protection of Adjacent USDWs**

Based on the modeling described above and the limitations on the allowable injection volume of  $1.3 \times 10^{10}$  gallons (500 gpm for 50 years), the proposed area for exemption provides adequate assurances that contaminants will not leave the aquifer exemption boundary. The models indicate migration a distance of slightly less  $\frac{1}{2}$  mile from the well downgradient. The location of the well relative to the property boundaries of the facility ensures no migration off-site or outside of the aquifer exemption boundary. The Mowry Formation above and the Swift Formation below will provide vertical confinement to the injection zone.

#### **CONCLUSION AND DECISION**

Based on review of the entire record, EPA finds that exemption criteria 40 CFR § 146.4(a) and 146.4(b)(2) have been met and EPA approves the AE request as a non-substantial program revision.

In making this decision, EPA considered all the information submitted by the State and the applicant. The NDDoH did provide an opportunity for public comment and hearing, consistent with EPA's regulation at 40 CFR § 144.7. No public comments were received on the permit or the aquifer exemption request. A scheduled public hearing was canceled due to a lack of interest.